

# Nursery Management & Orchard Planning

## ➤ Nursery

► Literally nursery means garden of seedlings and it is also called seedbed. So nursery is a place where seed, Seedling, sapling, cutting and other planting materials are produced and maintained with special care for planting other location or for sale.

► In other word, nursery is a such temporary place where seedlings, saplings, cutting, layers and grafts are produced scientifically through sexual and asexual method of propagation and nursed or they are ready to sell or planted in the permanent place.

## ➤ Modern nursery

When modern facilities are applied on nursery activities for improving seeds, Seedling, grafts, layers, cutting and greenhouse, lath house, mist propagating unit, tissue culture laboratory etc are present in a nursery then that the nursery is called modern nursery.

## ➤ Advantage/ Importance of nursery

1. To produce required number of Seedling, sapling.
2. Financially a person can be benefited.
3. Unemployment problem can be solved to some extent.
4. The Seedling or sapling can be obtained timely from nursery.
5. The Seedling or sapling which are not stored easily, this can be raised successfully in the nursery. E.g. Gorjon, Rubber, Telsur etc.
6. It helps the government and public in tree plantation by supplying seedlings timely.
7. It helps to inspire and motivate the public in tree plantation programme.
8. Unutilized land can be brought under production.
9. Nursery owner and government may be benefited by importing and exporting planting materials.
10. It acts as a store house of plant germplasm (Seed bank).
11. It may act as a training centre.
12. It contributes in the reduction of environment pollution (smokes, gas and dust).
13. It helps in increasing total forest land.
14. It contributes a lot in supplying food, medicine, Timber, fuel and nutrition.

15. It helps to maintain ecological balance for living being.

16. Maintenance is very easy and many propagation materials can be obtained with low price and less labour's.

#### ⇒ **Disadvantage**

1. Initial cost is so high that poor people are not able to make it easily.
2. It needs efficient and Technical person in the permanent nursery.
3. Transportation cost is high.
4. Sometimes high land and source of water are not available for making an ideal nursery.
5. Nursery can be affected by beasts especially in the forest nursery.
6. Seedling of nursery are very sensitive to diseases.

#### ⇒ **Mention the classification of nursery**

The classification of nursery as follows-

##### **1. On the basis of size-**

- a) Mini or small nursery.
- b) Medium nursery.
- c) Large nursery.

##### **2. On the basis of stability-**

- a) Permanent nursery.
- b) Temporary nursery.

##### **3. On the basis of growing place/condition-**

- a) Pot/polybag nursery.
- b) Bed/ground nursery.

##### **4. On the basis of quality-**

- a) Lower equality nursery.
- b) Medium quality nursery.
- c) High quality nursery.

##### **5. On the basis of economy-**

- a) Homestead nursery.
- b) Commercial nursery.

## 6. On the basis of plant type-

- a) Ornamental plant/flower nursery.
- b) Fruit nursery.
- c) Vegetables nursery.
- d) Forest plant nursery.
- e) Medicinal plant nursery.
- f) Mixed nursery.

## ⇒ Sections of a commercial nursery

For smooth functioning there are some sections in a big, permanent and commercial nursery which are as follows-

1. **Seed bed:** for raising of Seedling from seeds.
2. **Nursery bed:** for planting rooted, cutting, layers and rootstock for grafting and budding.
3. **Cutting bed:** to place cutting for rooting.
4. **Mother stock area:** to supply a scion and stock and cutting materials, layers made from these plant also.
5. **Threshing floor:** for threshing, winnowing and draying of seeds.
6. **Pot yard:** for keeping potted plants.
7. **Research plot:** for conducting research work.
8. **Irrigation source:** tube well, water Reservoir and pond.
9. **Area for the plant to display:** Rare, attractive, high yielding, exotic plants.
10. **Area for shade tree:** to provide shade to plants properly.
11. **Working shade:** to keep soil and to work during hot and rainy days.
12. **Office and store room:** office for official use and store room for storing seeds, tools and equipments, fertilizers, fungicides, insecticides etc.
13. **Roads and paths:** to visit different section of the nursery.
14. **Vehicles parking area:** to keep Car, trolley and other vehicles.
15. **Irrigation and Drainage channel:** for irrigation and Drainage of water.
16. **Compost plant:** for the preparation of compost.
17. Poly tunnel, net house, Lath house, green house, mist propagating unit area.



**18. Packing Yard:** for packing seedlings.

**19. Compost shade:** to keep compost in ideal condition.

**20. Staff quarter:** for residing.

**21. Cultivation area:** for the production of seed.

### ⇒ Describe site selection for a commercial nursery

Nursery is must to be established in such a place which considered ideal for high economic benefit. For this the following aspects may be considered-

**1. Location:** The location of a nursery is very important factor. The place must be easily visible, High, open, Sunny and free from flood and water logging condition. It should be near the city or town or high way.

**2. Communication:** The place must be well communicated. It may be by the side of a road, port or human habitation.

**3. Soil:** Soil of a nursery must be very fertile and loamy.

**4. Land value:** Value of suitable land for nursery must be researchable with the scope of availability of adjacent land for the extension of the nursery if required in future.

**5. Irrigation source:** It is good for nursery, if there is a source of water for irrigation. The source maybe river, Canal, Lake, pond etc.

**6. Labourers availability:** Easy availability of required number of labours whenever required with reasonable salary is one of the consideration.

**7. Materials availability:** Easy availability of fertilizers, improved seeds, insecticides, pesticides, hormones, tools, equipment etc.

**8. Other facilities:** Modern facilities like telephone, gas, electricity etc and socio economic condition of people may be considered. Transporting and marketing facilities should also be considered.

### ⇒ Steps for establishment of a nursery

The following steps are to be considered for establishment of a commercial nursery-

**1. Site selection:** The place where is considered for high economic benefit is to be selected for a nursery. Scope of growing required number seedlings and their huge demand are the main considerations. Location, communication, soil land value and easy availability irrigation source, materials and Labour availability and other facilities are to be considered in selecting a suitable site for a nursery.

**2. Boundary demarcation and fencing:** After demarcation of boundary, a perimeter fences is to be constructed to protect the nursery seedlings from animals and intruders.

**3. Naming and fixing of sign board:** Attractive sign board with a beautiful name of the nursery is to be fixed at the main gate.

**4. Layout and design:** For the smooth operation of the nursery, layout and design are to be prepared on a paper after measuring the area as per needs and facilities and ability marking the different sections.

**5. Land development:** With the cutting and digging tools all shrubs, grasses, Vines and other unwanted vegetations that may be disturb good functioning of the nursery and also Stumps and big stones are to be removed. Any depression or hole if present, is to be filled up with soil and the mounds are to be levelled for quick drainage of rainwater.

**6. Marking and preparation of different sections:** As per layout and design; house, office showroom, sales counter, store room, laboratory, working shade, lath house, net house, compost shade, poly tunnel and other sections like seedbed, nursery bed, pot yard, parking yard, packing yard, irrigation and Drainage channel, tube well, roads and pots, pond, threshing floor etc are to be marked with rope and pegs and constructed properly phase by phase.

**7. Collection of tools equipment and other materials:** Spade, khurpi, garden shear, khonta, secateurs, budding knife, grafting knife, hand saw, hand rake, watering cane, polybag, polythene, pod tube, rope, balance ladder, van, rubber pipe, fertilizer, cash memo register khata, pen, pencil etc are to be collected.

**8. Manpower employment:** Manager, skilled propagator, labours guard and other required manpower are to be appointed.

**9. Arrangement of modern facilities:** Arrangement of telephone, electricity, gas laboratory, library, greenhouse, lath house, net house, mist propagating unit etc may be made.

**10. Germplasm and other planting material collection:** Germplasm and planting materials of common and rare species varieties and officially released varieties are to be collected and planted temporarily or permanently in proper place. Then the activities of nursery will have to be started.

**11. Starting of nursery activities:** Seedlings raising, grafting, budding, seed production, potting and basing of plants other activities will have to be performed as per schedule.

### ⇒ **Management of nursery**

Nursery management may be defined as the sum of the activities, performed for the successful production, care and marketing of different planting materials (seeds, seedlings, cuttings etc) in different section of the nursery. Conducting employees properly, maintenance care and protection of properties etc.

Important management practices are briefly presented below-

**1. Management of protective fence:** Time to time repairing work of the fence may be needed.



- 2. Management of roads and paths:** To keep the roads and paths free from dust and mud, earth filling and mowing of grasses may be needed.
- 3. Management of irrigation and Drainage channels:** Channels prepared in the nursery should always be kept clean for easy and quick flow of water by removing weeds and silts.
- 4. Management of water sources:** Care of the tube well, pond etc is to be taken to ensure water supply during need.
- 5. Management of temporary plants:** Optimum quantities of nutrients and irrigation water are to be applied to the seedlings, saplings, cuttings, layers and grafts grown in the containers and in different section of the nursery whenever required. Proper measures against pests and diseases are to be taken. Weeding, mulching and training are the common practices. Extra soil with sufficient amount of organic matter maybe needed to add with the growing media of containers and beds.
- 6. Management permanent plants:** For healthy growth and development, proper care and maintenance like pruning, manuring, irrigation, application of insecticides and fungicides against pests and diseases etc are to be taken for the permanent plants. To provide shade and to supply stock, scion and other planting materials.
- 7. Management of planting material during marketing:** At the beginning of pick period of marketing, the planting material are kept ready for immediate sale in attractive condition. Carefully lifting of Seedling, grafts, layers, cutting etc is to be performed by the labours.
- 8. Management of structure:** Measures are to be taken to keep the nursery structure like greenhouse, Lath house, net house, poly tunnel, working shade, office store room etc in good working condition.
- 9. Management of tools and equipments:** To ensure high quality and the maximum quantity of work, the tools and equipments are to be kept always in good condition (Sharpe and rust free).
- 10. Management of staff:** Cordial relation is to be maintained among the staff so that they can perform their duties and responsibilities properly, sincerely and efficiently with inspiration.

### ⇒ Nursery bed

Nursery bed is a place of high land for raising of Seedling and is made with pillar bricks and furrows etc. It is just like a seed bed. This place is selected for planting of cutting, layers, grafts instead of seed sowing.

### ⇒ Preparation of nursery bed

For raising of seedlings two types of nursery bed is prepared in the nursery.

1. Bed for direct raising of Seedling.
2. Bed for rising of seedlings in the poly bags.

**1. Bed for direct raising of Seedling:** At first land should be prepared for making a bed. For this land is to be ploughed and the grasses are to be rooted out and the debris should be removed down the clods. If the soil is bad for making a nursery bed then fertile soil brought out from other location, maybe mixed with it thoroughly.

So, one cubic meter ( $\text{m}^3$ ) cow dung or compost is required for each of 10 square metres of nursery bed and 1.5 kg of urea, TSP and MP at the ratio of 4:2:3 are mixed with the soil of bed. The surface of land is to be levelled.

The bed should be height of 10 to 15 cm by making furrows/drain in and around the bed. The edge of bed is to be bounded. Post of wood or bamboo with a height of 30 to 35 cm is to be settled down vertically to the Soil around the bed.

Therefore, the branches of bamboos to be attached with the post. The edge of Bed can also be made with bricks.

**2. Bed of rising of Seedling in poly bag:** The terms of polybag, the land is not to be ploughed. The surface layer is to be levelled by earthing up of soil in the middle portion of two beds with a height of 10 to 15 cm. Then the edge is made up of bed. The edge of bed can be made with bricks or bamboo.

### **Potting**

Potting means pot culture for cultivation of plants in pot. High and deep pots are required for potting of plants. A hole is very essential at the bottom of pot for convenient of water removed. Rainy season is very suitable for pot plantation. It also can be done any time of the year.

Broken parts of soil made pot or bricks or stone with straw or dry leaves should be adjusted to the Pore of pot in such a way that's soil could never be escaped with water from the pot.

Compost and sandy loam soil at the ratio of 1:1 is mixed well and filled up the pot keeping 5 cm free from upward. Seedlings are to be planted at the middle portion of the pot and Swept the soil of pot with water fairly. The pot is kept in the shadow place for a few days. Therefore, it is transferred to the sunny area for establishment of Seedling.

### **Objectives of potting**

1. Potting is done for increasing the beautification of social and government occasion.
2. To beautify the homestead.
3. Easy for handling here and their.
4. In terms of breeding program, individual plant is produced and maintained with special care.
5. Potting is done for experimental research.
6. To protect plants from the adverse effect of sudden floods.

7. Potting is done for photo session.
8. To keep aromatic flowers in a specialised position.
9. Potting is done for the presentation of seedlings until the permanent place is ready for planting.
10. Potting is done for green house purpose.

### ⇒ **Depotting**

After 2 to 3 years plants of pot become weak inspite of its regular intercultural operations. In this circumstances, plants are required to be removed from pot. The process in which plants of pot are removed is called depotting.

If the root is strongly attached with soil of pot, it is very much essential to make it loose with the help of hand hoe for the removal of seedlings. The thamkin and big man are to be kept on the base of the seedlings and the pot should be layed with the face downwards and is jerked well and therefore the seedlings will be removed with the ball of soil having root zone.

### **Objectives of depotting**

1. To increase the fertility of pot soil.
2. To incorporate fertilizers and fertile soil.
3. To exhaust the pot after completing of research work.
4. To remove the dead and infected seedlings.
5. It is done for the sell of Seedlings.
6. To increase proper growth of plant.

### ⇒ **Repotting**

In this process the previous seedlings are new planted in the pot after the removal of existing soil. This process is known as repotting.

### **Objectives of repotting**

1. To increase the fertility of pot soil.
2. To transfer plant from a pot to another.
3. To transfer plant from a smaller pot to bigger pot.
4. To accomplish for making loose clod of soil.
5. To prune the root of pot plants.



## ⇒ Plant propagating structure

Success of plant propagation in modern nursery requires propagating in structural facilities. Essential nursery structures are green house, glass house, hot bed, cold frame, lath house or shade house. First two units have all facilities to control environment and last two units in which the young plants can be kept for hardening off.

## ⇒ Green house

A green house is a structure with walls and roof made chiefly of transparent material, such as glass, in which plants requiring regulated climatic conditions are grown.

Or,

A Green house maybe thought of as a permanent type of glass house are plastic containers used for growing the plants through proper artificial Management by controlling temperature, light, air and water. At present green house is an important propagating used in modern nursery. It is generally used where temperature is too hot or too cold. Biennial crops seeds like cabbage cannot be possible to produce in hot climate region. It is possible to initiate flowering by controlling temperature and day length. But its use in our country is limited because it is very costly. Green house are usually provided with sufficient heat to allow year around operation. They are provided with some means of ventilation in the side walls and near the top. The plants are grown in ground beds or in raised bed or benches, depending upon the crops and performance of the individual.

Most of the plant energy is derived from air and sunlight, hence optimum light conditions are important for many plants. It is preferable, the green house will receive maximum light and then provide shade when necessary. Wood, aluminium, glass/plastic, black cloth/polythene, pipe, tray or pot tank, iron Pillar, brick, cement, sand, bench, pump, electricity, automatic thermostat, filter pad etc are required to make a Green house. Lower portion of the wall (about 60-100 centimetre) is made of bricks to protect the glass from domestic animals.

## Types of greenhouse

In design there are three types of greenhouse-

**1. Lean to type:** It is consists of a single span. The simplest type of green house is one which has a roof slopping one direction. Such a lean to type may be placed against a building or may have its own solid back wall. The roof slope maybe toward the north when direct sunlight is not required or toward the South when the maximum available light is important. Length direction should be extended in East and West direction.

**2. Even span type:** The roof form a peak at the centre and slopes evenly in two direction. Walls of the even span type green house is made of glass but lower portion of the wall 90-100 cm is made of bricks.

**3. Green house range:** When Several even span green house made side by side is called green house range. Even if span contains either separate wall or not.

## ➤ Green house management

Green house management is to control the temperature, humidity, light and air for starting the plant. Green house is managed in the following ways-

### A. Green house heating

Heating is very important for successful green house operation. Green houses are commonly heated with steam or hot water pipe coils placed on the walls of the house and/or beneath the benches. Pipes are horizontally either under the benches or along the lower side of the walls. Coils or pipes are ordinarily used and may be valued and trapped depending upon the heat needed. The pipe is placed with hot water tank by one side and another side is attached with storage tank. A pump is set up with hot water tank and also a pilot lamp under the hot water tank. Automatic, thermostatically operated controls can be obtained for either steam or hot water systems. The hot water flows from the boiler tank to the storage tank. Temperature is controlled by thermostat. When, house temperature exceeds maximum, then pilot lamp is automatically off. Again pilot lamp works by reducing temperature.

### B. Green house cooling

Green house can be cooled down by the use of air conditioner, air cooler, moist pad etc. But first two systems are very costly, moist pad is generally used in the green house. This method is suitable in desert area. 10 centimetre thickness of a straw wall is made and placed with the side glass wall. Two exhausted fans are placed in opposite wall. When the fan moves, air flows from inside to outside. Straw wall is kept wet always. As a result, outside air enters the green house with vapour and the greenhouse cools down. Exhaust fan again expels the hot air out of the green house. A humidistat is placed in the green house to measure and control the moisture.

### C. Green house light controlling

The roof of the green house is painted by lime or white washed to protect the green house. A humidistat is placed in the green house to measure and control the moisture of plants from extreme sunlight. As a result, the green house becomes shady. Besides this, light intensity is reduced by using cloth on the roof. Again, light duration and light intensity are increased by using different spectrum bulbs. Bulbs are controlled by switch or automatic regulator.

### D. Green house ventilation

Ventilation is necessary to control air temperature to provide fresh supplies of Oxygen and to maintain air circulation. Stagnant air with water vapour may result in trouble from mildew. In many houses, vents are used for ventilation placed at the top or ridge of the house. These vents are normally controlled by the mechanical devices either manually operated or automatically controlled.

### E. Green house watering

Water is supplied in the green house with the help of pump. Small pipes can be used for this purpose to stimulate drip method. Essential nutrients for plants can be added with the tank water. Some narrow pipes are attached to the tank which supply water to every plant as in case of drip method. Mist irrigation can also be used.



## ⇒ Hot beds

Hot bed is generally used for a longer period in the cold season area. It is used in the early season or to produce/grows early Seedlings. In general, the frame is made of wood, steel, aluminium or concrete. The cover is made of glass or plastic. Hot bed is made of these two materials with facilities to control inside temperature. Required temperature is maintained under the media used. For propagation of plants, using artificial hot air, hot water or by radiating heat through electric cable. Temperature is controlled by a thermostat.

## ⇒ Cold frame

Cold frame construction is almost identical with that of hot bed, except that no provision is made for supplying Artificial heat. The movable sash or glass frame is ordinarily used to supply essential heat by trapping sunlight. So, cold frame is placed in the sunny location and protected from cold winds.

- ▶ The sash covering is placed from north to south direction in slope.
- ▶ Success of a cold frame depends on the control of light, air, shade and irrigation.
- ▶ Cold frame is not suitable for tropical countries.
- ▶ It is used to produce easily seedlings from seed, hardening off the rooted cuttings or young seedlings. I.e. plant started in hot bed or green house maybe hardened off in a cold frame prior to transplanting in the field.

## ⇒ Lath house

Lath house is a structure which is used in the nursery. The structure which are very useful in providing protection from the sun, giving temporary shade to the plants is called lath house. This is also called shade house.

- ▶ Such structure are also valuable as an intermediate step between the green house and the hot bed or the cold frame.
- ▶ Lath house construction varies widely.
- ▶ This house generally becomes 2 to 3 metres in height and is made of bamboo wood or pipe. Shade is provided by 5 by 2.5 cm strips set about 5 cm apart.
- ▶ This sides as well as the top are usually covered. It is not costly, so in our country it may be used.

## ⇒ Net house

Temperature control or cooling system of green house is very costly in the tropical countries. So, in these countries, their commercial uses are limited. Net house is used as a substitute of green house for different purposes in tropical countries. The roof of the net house is made of glass or plastic and fenced with net around the net house to provide heat in the cold season and to make it cool in warm season. Sometimes it is kept cool by covering the roof with gunny cloth or Climbing Plants. Like green house, net house may also be of different sizes and houses of different sizes may be made inside it.

## ⇒ Mist propagating unit

Mist propagating unit is essential for modern nursery. Air humidity is increased by spraying water into the form of Mist which protects the cuttings from desiccation. The place where it should be done is called mist propagating unit. Mist irrigation is controlled by automatic regulator. After 4 or 5 seconds, the Switch is automatically off. If automatic regulator facilities absent then rubber or plastic pipe or watering cane should be used for Mist irrigation purposes. The nursery bed must be sufficiently retentive of moisture but not access.

## ⇒ Pruning

► In horticulture, “ The removal or reduction of parts of a plant, tree or vine that are not requisite to growth or production, are no longer visually pleasing or are injurious to the health or development of the plant”.

► According to Gardner, pruning may be defined “as an art or science of cutting away a portion of plant to improve the quality of the product or to heal/repair the injury, the parts commonly removed are branches or leaves or both, obviously pruning is a subtraction process.”

## Objectives

To extent and intensity of pruning on the same tree varies from year to year, depending on the growth of the tree, its bearing and season. The following are the main objectives of pruning.

1. To maintain the growth and vigor of the trees and to maintain a balance between the vegetative vigour and fruitfulness, so as to be conducive for production of optimum crop of best quality.
2. To regulate the size and quality of fruit by way of proper distributions of the fruiting area.
3. To regulate the succession of crop.
4. To spread the tree for convenience of economy in orchard management.
5. Longevity of the tree.
6. To Chances of insects-pests, diseases and winter injury are less.
7. To maintain Proper proportion of root-shoot ratio.

## Principles of Pruning

1. Excessive pruning should be avoided as it affects the growth of the plant by 'dwarfing' and may induce more of eater suckers fascination and thus effect the bearing potential.
2. In pruning only that wood which is not necessary for the tree should be removed.
3. Pruning of large limbs should be avoided as far as possible.
4. Pruning of young trees should be done more carefully than they yielding trees since serve pruning of young tree to going to delay the cropping and much since serve pruning of young trees raging to delay the cropping and much more yielding area will be removed than what is desired.



5. Each branch or part pruned or removed should be considered as a potential bearing area and certain amount of food prepared the plants is reduced through such removed part.

## Methods of Pruning

- 1. Thinning Out:** This refers to the removal of the branches entirely from its base leaving no stubs.
- 2. Heading Back:** This refers to pruning or cutting of main stem or all or few of the branches leaving a basal portion. This method is often followed for hedges, ornamental shrubs, first dormant pruning and October pruning in grapes.
- 3. Disbudding or Rubbing off:** Here the young buds are nipped without giving them the chance to sprout. The buds may be either Vegetative or reproductive. This is practiced regularly in flowering plants to make the terminal bud to give a bigger flower.
- 4. Pinching and Topping:** This refers to the removal of the tip of the shoot alone with a view to stimulate mildly the lateral growth; this is practiced regularly in coffee to remove the apical dominance and to allow the side branches to grow vigorously. e. g Deshi cotton.

## ⇒ Training

### Definition

- ▶ Training is a practice in which tree growth is directed into a desired shape and form.
- ▶ Training can therefore be defined as ‘an operation done to a plant by which it is made to develop an frame work or structure and this is spreading on pergola with or without pruning of plant pears and training is usually done when the plant / shrubs vines are young.

It is necessary to pay sufficient attention for training of plants during the first few years of planting. During this period, the pre planned frame work as decided by the grower should be allowed to develop.

### Objects

1. To admit adequate sun light and air to the center of the tree and to expose maximum leaf area to the sun.
2. To limit the growth and spread of the tree so that various cultural operation such as spraying and harvesting are performed at minimum cost.
3. To build the frame work and arrangement of scaffold branches.
4. To build the structure of the tree at such heights at which the trees are less exposed for sunscald and wind damage.
5. To protect the tree from sunburn and wind damage.
6. To secure a balanced distribution of fruit bearing parts on the main limbs of the plant.

### ⇒ Distinguish between training and pruning

| Training   | Pruning  |
|--|--|
| 1. Mainly concerned with giving a form or shape to the plant.  | 1. Pruning is the removal of a portion of a tree to correct or maintain tree structure.  |
| 2. Training determines the general character and even details of plant out line its branching and frame work.                        | 2. Pruning determines the capacity of plant to produce fruit.  |
| 3. By training we can keep the plant or vine in a manageable shape and can dispose the branches in desirable direction and position. | 3. BY pruning we can actually drive the flow of sap towards fruiting area on plant and force the plant or vine bear better quality of fruits e.g. Grape. |
| 4. Training includes summer training and summer pruning as well as dormant Pruning.  | 4. Pruning is most often done during the winter, commonly referred to as dormant pruning. Also done during summers, referred to as summer pruning.       |
| 5. The goal of tree training is to direct tree growth and minimize cuttings.   | 5. It is meant to assist more in determining what the tree does in respect of fruiting.  |

### ⇒ Planning of an orchard

A careful plan of the orchard is necessary for the most efficient and economic management. The following points should be borne in mind in preparing the plan.

1. Optimum spacing to accommodate maximum number of trees per unit area.
2. Stores and office building in the orchard should be constructed at the centre for proper supervision.
3. Wells should be located at convenient places in different parts at the rate of one well for 2 to 4 hectares.
4. Each kind of fruit should be assigned in a separate block.
5. Fruits ripening at the same time should be grouped together.
6. Pollinators should be provided in deciduous fruits. In deciduous fruit trees, there are some varieties which require pollen from another variety to set fruits in them, otherwise, they will be barren. Such pollen donors are known as pollinators. Every third tree in every third row should be planted with a pollinator.
7. Irrigation channels should be laid along the gradients for most economical conduct of water. For every 30m length of channel, 7.5 cm slope should be given.
8. Roads should occupy minimum space for the economy of transport. The clearance between wind break and first row of trees is advantageous for the road.



9. Short growing trees should be allotted at the front and tall at the back for easy watching and to improve the appearance.
10. Evergreen trees should be in the front and deciduous ones behind.
11. Fruits attracting birds and animals should be close to the watchman's shed.
12. A good fence is essential. Live fencing is economic and cheap to other kind of fences. The plants suitable for live fencing should be drought resistant, easy to propagate from seed, quick growing, have dense foliage, should stand severe pruning and should be thorny.

### ➡ Location and site selection

Proper selection of site is important. Selection may be made based on the following criteria.

1. The location should be in a well established fruit growing region because one could get the benefit of experience of other growers and also get the benefit of selling the produce through co-operative organizations with other fruit growers.
2. There should be a market close to the area.
3. The climate should be suitable to grow the chosen fruit crops.
4. Adequate water supply should be available round the year.

► Before a grower selects a site for establishing a new orchard, he must have assessed the following factors:

1. Suitability of soil, its fertility, the nature of subsoil and soil depth.
2. Site must have proper drainage and no water stagnation during rainy season.
3. Irrigation water must be of good quality.
4. There must be proper transport facilities either by road or rail within the reach.
5. Whether the climatic conditions are suitable for the fruits to be grown and are whether site is free from the limiting factors such as cyclones, frost, hailstorms and strong hot winds.
6. Whether there are seasonal gluts or over production in any particular period of the year.
7. Whether there is assured demand in the market for the fruits to be grown.
8. Whether his orchard is a new venture or whether there are already other growers.
9. Availability of labour.

## ⇒ Layout of orchard planning

The marking of position of the plant in the field is called **Layout**. The various layout systems used are the following:

### a) Vertical row planting pattern

**1. Square system:** In this system, trees are planted on each corner of a square whatever may be the planting distance. This is the most commonly followed system and is very easy to layout. The central place between four trees may be advantageously used to raise short lived filler trees. This system permits inter cropping and cultivation in two directions.

**2. Rectangular system:** In this system, trees are planted on each corner of a rectangle. As the distance between any two rows is more than the distance between any two trees in a row, there is no equal distribution of space per tree. The wider alley spaces available between rows of trees permit easy intercultural operations and even the use of mechanical operations.

### b) Alternate row planting pattern

**3. Hexagonal System:** In this method, the trees are planted each corner of equilateral triangular. This way six trees form hexagon with the seventh tree in the center. The trees are equally spaced from each other. In this system inter cultivation is difficult. This system provides equal spacing but it is difficult to layout and the cultivation is not so easily done as in the square system.

**4. Triangular System:** In this system, they are planted as in the square system but the plants in the 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup> and other alternate rows. Triangular system is based on the principle of isosceles triangle. These systems have no special advantages over the square system except more space for the trees and inter crops. It is difficult for layout cultivation.

**5. Diagonal or quincunx system:** This is the square method but with one more plant in the centre of the square. This will accommodate double the number of plants, but does not provide equal spacing. The central tree is usually the filler tree which only for a shorter period. In this layout population becomes double than square system of mango+papaya, mango+fig.

**6. Contour system:** It is generally followed on the hills where the plants are planted along the contour across the slope. It particularly suits to land with undulated topography, where there is greater danger of erosion and irrigation of the orchard is difficult. The main purpose of this system is to minimize land erosion and to conserve soil moisture so as to make the slope fit for growing fruits and plantation crops.

## ⇒ Orchard Management

**1. Orchard Establishment:** Orchard site selection, soil conditions, replant site considerations, economics, variety and rootstock selection, orchard systems and designs and crop protection etc are included in an orchard establishment.

**2. Soil & nutrition:** Indicators of soil quality are structure, water holding capacity, infiltration, pH, soil organic matter, and microbial activity. Preferred orchard soil is a stable, sandy loam soil that is



granular and porous, enabling good water and air movement. Soil pH around 6.0 to 7.5, slightly acidic is optimal for fruit trees to absorb nutrients. Replant disease, nutrient excess or deficiencies, poor soil texture, poor water holding capacity or poor water drainage (e.g., waterlogging) are all important soil issues.

**3. Environmental Stress Management:** During the summer, solar radiation levels are extremely high, and often exceed levels that can be utilized by the trees. When coupled with high air temperatures, which also raise the fruit temperature, sunburn browning and other skin disorders can result making fruit unmarketable. For young trees that do not yet have an adequate canopy established, sunburn can also occur to the unprotected bark of south facing tree trunks.

Cold temperatures can also result in damage; whether it is before the trees become completely dormant in the fall, during winter dormancy or during early growth and flowering in the spring. Hail can cause cosmetic damage to fruit making it unmarketable and also cause physical damage to leaves, shoots, spurs and bark. The latter may produce wounds that could lead to disease infection and insect invasion.

**4. Pruning and Training Systems:** Fruit trees are pruned for a number of reasons including: tree architecture and size, sunlight infiltration, air circulation, strength, production, and tree health. Fruit tree training helps develop strong tree architecture that can support crop loads and bring young trees into early production.

**5. Irrigation Management:** Fruit trees require adequate moisture to maintain growth, take up nutrients, and produce high quality fruit. Choosing the right irrigation system to deliver the appropriate amounts of water is essential.

**6. Orchard Floor Management:** Orchard floor management decisions impact the health of fruit trees and overall production and quality of fruit. Soil condition, nutrient availability, water management, weed control, insect habitat and prevalence of rodents all influence the growth, development and productivity of fruit trees. Orchard floor vegetative ground cover provides traction for tractors and machinery, protects the soil from erosion by wind and water, prevents runoff, facilitates water percolation and helps manage dust.

**7. Pollination:** Pollination timing and availability of compatible pollen are key to fruit production. Pollen is primarily transferred by honeybees. Trees placed more than 100 feet away may result in poor pollination. Bees work best when temperatures are above 65°F. Cool weather, rain or winds may prevent bees from leaving their hives. Most pesticides are toxic to bees and should not be used during bloom time.

**8. Crop Load Management:** Managing crop load is important for setting quality fruit and the health of the tree.

**9. Harvest:** Harvest timing for tree fruit crops varies based on the fruit type and variety. Various fruit maturity-testing methods are used to help determine when fruit are ready for harvest.

## ➡ Irrigation Management of Orchard

Fruit trees require adequate moisture to maintain growth, take up nutrients and produce high quality fruit. Good irrigation planning and management are essential for orchard health and grower profitability.

The amount of water required by fruit trees depends on the type and age of trees, their spacing in the tree row, soil type, site location, climate, and other environmental variables. Irrigation management influences tree health, the rate of tree growth, utilization of nutrients, fruit size and crop yield.

Newly planted trees need to be watered as soon as possible after planting to avoid water stress and this is especially important with larger trees and when temperatures are high during or immediately after planting. Growers try to maximize tree growth for the first few years to ensure adequate canopy growth before production starts, so precise irrigation is important. Young trees need a consistent water supply to achieve the greatest growth potential.

There are certain times during the growing season when lack of water can be detrimental to fruit production. The month after full bloom is the time when the most rapid cell division in fruit is occurring. Receiving the right amount of water at this time is critical for good final fruit size and quality. For stone fruits, especially, the final fruit swell phase that occurs approximately two-three weeks before harvest is also an important time for trees to receive enough water for fruit growth. Care needs to be taken during this phase, in sweet cherries, for example, to avoid excess water that can lead to fruit cracking or splitting making them unmarketable.

Choosing the correct irrigation system to deliver the appropriate amounts of water at the needed times is essential. Inadequate water can lead to tree stress, inadequate nutrient uptake and shoot growth, reduced fruit size and quality.

Excess water can lead to erosion, loss of nutrients due to leaching, higher pumping costs, increased root disease and potential adverse off-target environmental impacts when chemicals may be leached into streams and other bodies of water.

The available water holding capacity (WHC) is the amount of water a particular soil type will hold for plants to use. Different soil types have different water holding capacities. For example, sand has a limited water holding capacity because water will drain quickly through large permeable pores. Clay on the other hand, has a large water holding capacity due to small pores that are not as permeable.

Water holding capacity is also affected by the number of trees utilizing the water in the soil, as there is not as much water holding capacity in high density plantings as in low density plantings.

Preferred orchard soil is a stable, sandy loam that is granular and porous, enabling good water and air movement, and adequate field capacity (soil water content). It is important to determine the soil type at orchard site, when considering the type of irrigation system to install.